Burrowing Owl

Athene cunicularia

Last updated: 2003

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GENERAL RANGE AND WASHINGTON DISTRIBUTION

The breeding range of the burrowing owl includes southern Canada from southern British Columbia eastward to south-central Manitoba, and extends as far south as Mexico (Haug et al. 1993). This species was extirpated from British Columbia but was reintroduced into the province in 1983. In Washington, burrowing owls typically occupy shrub-steppe habitat of the eastern part of the state during the breeding season (see Figure 1; Bryant 1990).

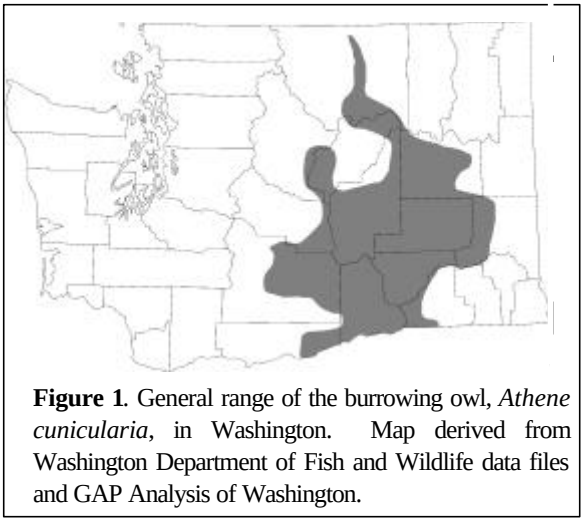

Figure 1. General range of the burrowing owl, *Athene cunicularia*, in Washington. Map derived from Washington Department of Fish and Wildlife data files and GAP Analysis of Washington.

Burrowing owls winter mainly in the southern United States, central Mexico and Central America (Zarn 1974). Little information is available on the migration routes and times or wintering areas used by burrowing owls (Haug et al. 1993). Recent banding data have shown that some owls overwinter in eastern Washington (Conway et al. 2002). Additionally, a resident owl was recently found with eggs that were produced in late February (C. Conway, personal communication). Most burrowing owls from Canada and the northern United States are believed to migrate south in September and October. The northern migration to the breeding grounds is thought to occur from March through the first week of May (James and Ethier 1989, James 1992, Haug et al.1993).

RATIONALE

The burrowing owl is a State Candidate species and a Federal Species of Concern that was once widespread throughout steppe and prairie communities of North America. Currently, the burrowing owl is declining throughout much of its range in the western United States and Canada (Bent 1961, Holroyd and Wellicome 1997, Sheffield 1997). Breeding Bird Survey data for the Columbia Plateau indicate increasing populations, although this estimate is considered imprecise (Sauer et al. 2001).

HABITAT REQUIREMENTS

Burrowing owls inhabit open, dry areas in well-drained grasslands, shrub-steppe, prairies and deserts (Martin 1973). They also nest on agricultural lands and suburban areas (Haug et al. 1993). They use burrows for nesting, shelter, protection from predators and to reduce exposure to extreme temperatures (Zarn 1974, Winchell 1994). Although they are capable of digging, burrowing owls usually depend on abandoned burrows excavated by burrowing rodents such as prairie dogs (*Cynomys* spp.) and ground squirrels (*Citellus* spp.), or by larger mammals such as badgers (*Taxidea taxus*), foxes (*Vulpes* spp.) or coyotes (*Canis latrans*) (Mutafov 1992). In the Pacific Northwest, nesting burrowing owls often use unoccupied badger dens (Green and Anthony 1989).

The primary habitat characteristics preferred by burrowing owls include a complex of available burrows, short and/or sparse vegetation that provides good visibility, and adequate populations of prey species (Haug et al. 1993). Soil type affects the life and reusability of nesting burrows (Green and Anthony 1989, Holmes et al., in press). Specifically, the friable nature of sandy soils results in relatively high rates of burrow failure due to erosion and trampling by livestock. Silt-loam soils are more structurally stable and less likely to fail than are soils with a sand component.

Although badgers provide nesting sites for burrowing owls in Washington, they also are one of the owl's main predators (Haug et al. 1993). Burrowing owls line their nests with shredded livestock or ungulate dung, which may reduce nest predation by masking the owl's scent (Martin 1973, Zarn 1974, Green and Anthony 1989). However, several research teams have recently examined the use of dung by owls and found that this conclusion may not be true (C. Conway, personal communication).

Burrowing owls appear at breeding sites in February, and hatchlings emerge in May (C. Conway, personal communication). Recent observations suggest that resident owls initiate nesting earlier than migratory owls (C. Conway, personal communication). Incubation lasts approximately 28 days, and owlets emerge from the burrow about 2 weeks after hatching. At 2 to 3 weeks, the young begin to use other burrows near their nest burrow (C. Conway, personal observation). Paired owls will use up to 10 auxiliary burrows that are within 90 m (300 ft) of their primary nesting burrow (Climpson 1977). These auxiliary burrows are used to provide escape cover from predators, as secondary burrows for fledgling owlets and as alternates if the primary nest becomes heavily infested with parasites (Winchell 1994). Nests may also be located in natural cavities in small rock outcrops (Rich 1986). Nest burrows are often reused in successive years (Haug et al. 1993, Lutz and Plumpton 1999). There are no known records for a second brood during the breeding season in Washington (Haug et al. 1993).

The number of available burrows is not the only factor owls use to select a breeding site. They also look for areas that are open, with short and/or sparse vegetation and good horizontal visibility to see predators and locate prey (Green and Anthony 1989). In areas containing shrubs, they choose nesting burrows located near perches (Martin 1973, Green and Anthony 1989). Burrowing owls hunt by chasing prey items on foot or by catching them in the air (Haug et al. 1993). Their diet changes throughout the day, with insects most often caught during daylight and mammals preyed upon after dark (Martin 1973, Plumpton and Lutz 1993a).

Food availability and quality is likely to affect nesting densities of these owls for a given location (Desmond and Savidge 1996). Burrowing owls are opportunistic feeders, but they consume mostly insects and mammals (Green and Anthony 1989). Other prey species include birds, amphibians and reptiles (Zarn 1974, Gleason and Craig 1979, Mutafov 1992, Haug et al. 1993). Green and Anthony (1989) found a seasonal variation in diets, with rodents making up most of the owl's diet in the spring, and then shifting their diet almost exclusively to insects during the summer.

LIMITING FACTORS

Human activities that eliminate nesting and foraging habitat are likely the primary cause of this species decline (Haug et al. 1993, Sheffield 1997, Belthoff and King 2002). Intensive cultivation of shrub-steppe, grasslands and native prairies has long been recognized as a primary cause of the declining burrowing owl population (Haug et al. 1993). Agriculture and other development also expose owls to pesticides and increase their vulnerability to predation (Haug et al. 1993, Sheffield 1997). Although some burrowing owls take advantage of crop fields to exploit abundant food sources during the winter, intensive cultivation of native grasslands is a suggested cause of declines in populations of breeding owls (Haug et al. 1993). The burrowing owl is also limited

by the availability of mammal burrows. Additional mortality has been attributed to collisions with automobiles and shooting (Butts 1973, Haug et al. 1993).

Habitat Alteration

Although not all nesting burrowing owls use multiple burrows, some nests are associated with multiple burrows in close proximity to one another (Holmes et al., in press). The availability of burrows is reduced directly by destroying them (e.g., trampling of burrows by livestock and diking/tilling) and indirectly by eliminating or reducing the numbers of the animals that excavate the burrows (Haug et al. 1993). Burrow destruction by humans and dogs also occur. Thomsen (1971) estimated that 65% of the damaged burrows at her study site were caused by humans and 20% by domestic dogs. Large-scale efforts to control burrowing mammal populations can harm burrowing owls in areas where they rely on rodent burrows (Butts 1973, Holroyd et al. 2001).

Pesticides

Pesticides (specifically insecticides and rodenticides) can harm burrowing owls by causing direct mortality or sublethal effects such as decreased body weight and low reproductive success (Haug et al. 1993, Sheffield 1997, Holroyd et al. 2001). Indirect problems such as a decrease in available prey also occurs (James and Fox 1987). Burrowing owls are susceptible to secondary poisoning from insecticides and rodenticides because they feed on carcasses of poisoned prey species (Haug et al. 1993).

Direct exposure to carbofuran, a carbamate insecticide used to control grasshoppers, can significantly impact the survival and reproductive success of burrowing owls (James and Fox 1987, Mutafov 1992). When carbofuran (Furadan 480F) was applied over nest burrows, the number of young was reduced by 83% and nesting success was reduced by 82% (Mutafov 1992). In some instances, sprayed areas were less frequently occupied the following year by burrowing owls.

James et al. (1990) studied the control of ground squirrels with strychnine and its impacts on burrowing owls in southern Saskatchewan. They found, at least in the short term, no direct lethal effects on breeding burrowing owls. Adult survival, breeding success and chick weights were virtually the same in both treated and untreated areas. However, adult owls weighed significantly less in the treated versus the control sites, suggesting a sublethal effect on the species. Winchell (1994) states that nuisance rodent species can be baited or fumigated safely if care is taken not to treat burrows used by owls. However, even if burrowing owls escape inadvertent poisoning, their numbers will likely decrease because fewer burrowing mammals are creating new excavations for owl nesting and because of reduced available prey (C. Conway, personal communication).

Other Human Disturbances

Burrowing owls seem tolerant of human presence. However, Millsap and Bear (1988) found that reproductive success of burrowing owls in Florida was less at sites where home construction was taking place than at sites adjacent to construction, or where construction was absent.

Burrowing owls can also apparently become accustomed to vehicular traffic. However, nesting near roads may increase burrowing owl road kills. Plumpton and Lutz (1993b) found that vehicular traffic on roads near nesting sites did not create disturbance significant enough to influence the behavior of nesting owls. Unfortunately, owls frequently sit and hunt on roads at night, and collisions with vehicles occur frequently (Mutafov 1992).

Competition

Green and Anthony (1989) conducted a two-year study of 76 burrowing owl nests in the north-central Oregon and found nesting success to be only 57% the first year and 50% the second. Desertion was the primary reason for nest failure, which may have been related to the proximity of other nesting owls. Nestling mortality was greatest when pairs nested closer than 110 m (360 ft) apart. Green and Anthony (1989) suggested that in the Columbia Basin, nest sites were both clumped and scarce, forcing owls to nest too closely. If food sources are scarce, competition may then be strong enough to force some pairs to abandon their nests. Bryant (1990) found that competition might also limit the nesting success and return rates of burrowing owls reintroduced to areas

they historically occupied. Owls returning to their breeding grounds selected burrows as far away from neighboring owls as possible.

MANAGEMENT RECOMMENDATIONS

Protect Existing Habitat

Important ecological characteristics of areas used by burrowing owls should be maintained (Sheffield 1997). This includes preserving areas of native vegetation (e.g., shrub-steppe) and protecting burrowing mammal species (e.g., ground squirrels, badgers that create nesting habitat) for burrowing owls (Holroyd et al. 2001, Holmes et al., in press). Colonies of burrowing mammals should be preserved in areas where burrowing owls occur.

Nesting and satellite burrows should be protected from disturbance (Winchell 1994). Problems such as agricultural equipment collapsing burrow entrances and the inadvertent application of pesticides to occupied burrows can be reduced by placing markers near the burrows (Zarn 1974). Rangelands with sandy soils are especially prone to destruction of burrows by livestock (Holmes et al., in press). Where damage to burrows is likely or occurring, changes should be made in stocking rates, duration and/or season of grazing.

Activities such as oil and gas exploration and development, or other sources of human disturbance, should be restricted within 0.8 km (0.5 mi) of burrowing owl nests between 15 February and 25 September (T. Lloyd, personal communication; C. Conway personal communication). Direct destruction of burrows through chaining (dragging a heavy chain over an area to remove shrubs), cultivation, and urban, industrial, or agricultural development should be entirely avoided. Irrigation troughs should be regularly maintained because burrows often flood as a result of leaking irrigations systems (C. Conway, personal communication).

Local and regional government programs should be reviewed to ensure they address long-term conservation of burrowing owl habitat (Holroyd et al. 2001). Specifically, critical areas protection that fall under Washington's Growth Management Act could be a useful tool to conserve species, such as the burrowing owl, that are limited by loss of native habitat. Local development regulations could be designed to require mitigation and provide incentives to reduce potential impacts to this species resulting from proposed projects in owl habitat. Many resource agencies, including WDFW, have staff that can provide recommendations to assist in critical areas planning.

Pesticides

Insecticides and rodenticides are likely to harm burrowing owls directly through poisoning as well as indirectly by reducing populations of burrowing mammals (Holroyd et al. 2001). Therefore, it is recommended that alternatives should be researched thoroughly before resorting to their use. If pesticide use is planned for areas where burrowing owls occur, refer to Appendix A for contacts that can help evaluate pesticides and their alternatives.

Insecticides used in grasshopper control programs, especially carbofuran, have been shown to reduce reproductive productivity in burrowing owls. Carbofuran should not be applied within 250 m (820 ft) of active burrowing owl nests (Haug et al. 1993). Active burrowing owl nests should not be directly sprayed with any pesticide (James and Fox 1987, Lynch 1987).

Fumigation, treated bait or other means of poisoning nuisance animals should not be used in areas where burrowing owls occur. Burrowing owls are likely to scavenge the carcasses of poisoned rodents, making the owls potentially vulnerable to indirect poisoning (Sheffield 1997).

In cases where there are no alternatives to controlling burrowing mammals with poisoned bait or fumigation, thoroughly survey the area for burrowing owls during the nesting season (March through September) (Zarn 1974). Identify and mark nesting and satellite burrows by observing sentry owls, owl droppings and tracks, pellets, and dry, shredded animal dung. The use of treated grain to poison mammals should be restricted to the months of January and February (Butts 1973, Zarn 1974).

Mitigation

Artificial nest burrows are useful for expanding the capacity of existing nesting sites, and in transplant operations where burrowing owls are reintroduced into parts of their former range (Thomson 1988). Artificial burrows can also give researchers opportunities to study burrowing owl nesting ecology without destroying existing burrows (Bryant 1990, Olenick 1990, Haug et al. 1993). Dring (2000) and Green and Anthony (1997) have published papers that touch upon the design and use of artificial nesting burrows. State or federal wildlife agencies should be consulted for additional guidance prior to using artificial nesting burrows.

Artificial perches such as fence posts or stakes can be used in areas where vegetation is greater than 5 cm (2 in) tall (Green and Anthony 1989). Several perches scattered throughout the nesting area should benefit this species. Additionally, these and other mitigation measures could be incorporated into local critical areas ordinances where this species exists.

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KEY POINTS

Habitat Requirements

- Burrowing owls inhabit open, dry areas in well-drained grasslands, shrub-steppe, prairies and deserts. They also nest on agricultural lands and suburban areas.
- Preferred characteristics of burrowing owl habitat include a complex of available burrows, short and/or sparse vegetation that provides good visibility, and an adequate availability of prey.

Management Recommendations

- Preserve areas of native vegetation (e.g., shrub-steppe) used by the burrowing owl.
- Protect populations of badgers and other burrowing mammals that provide nesting habitat for burrowing owls.
- Direct local and regional government programs and policies (e.g., critical areas regulations) to ensure the survival of species, such as the burrowing owl, that are limited by loss of native habitat.
- Refer to Appendix A for contacts that should be used when evaluating pesticides and their alternatives. Insecticides and rodenticides have the potential to harm burrowing owls, and it is recommended that alternatives should be carefully considered before resorting to their use.
- Carbofuran should not be applied within 250 m (820 ft) of active burrowing owl nests. Active burrowing owl nests should not be directly sprayed with any pesticide.
- Fumigation, treated bait or other means of poisoning nuisance animals should not be used in areas where burrowing owls occur. Burrowing owls are likely to scavenge the carcasses of poisoned rodents and are potentially vulnerable to secondary poisoning.
- If there are no alternatives to controlling burrowing mammals with poisoned bait or fumigation, survey for burrowing owls during the nesting season (March through September). Identify and mark burrows used by owls by observing sentry owls, owl droppings and tracks, pellets, prey remains and burrows lined with dried animal feces.
- If all alternatives have been exhausted, poisoning of burrowing mammal colonies with treated grain should be restricted to January and February to minimize harmful effects to burrowing owls.
- Protect both nesting and auxiliary burrows from disturbance. Markers placed at burrows can direct earth moving and other heavy equipment away from burrowing areas and help prevent the collapse of underground passages. In addition, markers can help direct pesticide applications away from occupied burrows.
- Where damage to burrows from livestock trampling is likely or is occurring already, changes should be made in stocking rates, duration and/or season of grazing.
- Restrict activities such as oil and gas exploration and development or other sources of human disturbance within 0.8 km (0.5 mi) of burrowing owl nests between 15 February and 25 September. Direct destruction of burrows by urban, industrial or agricultural development should be avoided entirely.
- Artificial nest burrows can be used to expand the capacity of existing nesting sites and can aid in the reintroduction of owls into parts of their former range.
- Artificial perches, such as fence posts or stakes can be used in areas where vegetation is greater than 5 cm (2 in) tall. Several perches scattered throughout the nesting area might be required to benefit this species.